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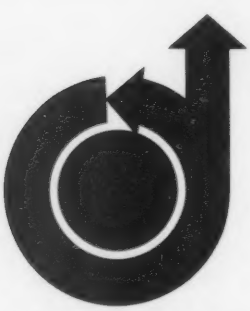

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Edited by William G. Schmidt, CML Satellite Corp,. and Gilbert E. LaVean, Defense Communications Agency

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The various aspects of base flow control through injection and combustion in the base region are presented in this volume. The first paper in this volume is an extensive review of the fluid-mechanical literature on wakes and base flows, which may serve as a guide to the reader in his study of this aspect of the base pressure control problem. This book deals with both base and external combustion under small and large injection conditions.

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For the study of metal combustion, the reader is referred especially to the two previous volumes in the series: Volume 1, Solid Propellant Rocket Research, and Volume 15, Heterogeneous Combustion.

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HEAT TRANSFER WITH THERMAL CONTROL APPLICATIONS

v. 39

Edited by M. Michael Yovanovich, University of Waterloo

This volume is concerned with the application of principles of heat transfer to one of the most complex engineering tasks in environmental control, the maintenance of thermal equilibrium in an isolated spacecraft thermal control system have necessitated a wide expansion of knowledge in fields such as surface emission and absorption characteristics, radiative exchange in complicated geometries, thermal contact resistance conduction in heterogeneous media, heat pipe phenomena, etc. The knowledge thus developed in the field of heat transfer, stimulated by the special requirements of spacecraft thermal balance and control, is directly applicable to many other engineering heat transfer projects. The book is recommended, therefore, to the broad community of heat transfer engineers as well as to the more specialized engineering community.

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AEROACOUSTICS: FAN, STOL, AND BOUNDARY LAYER NOISE; SONIC BOOM; AEROACOUSTIC INSTRUMENTATION

v. 38

Edited by Henry T. Nagamatsu, General Electric Research and Development Center; Jack V. O'Keefe, The Boeing Company; and Ira R. Schwartz, NASA Ames Development Center

A companion to Aeroacoustics: Jet and Combustion Noise; Duct Acoustics, volume 37 in the series.

Twenty-nine papers, with summaries of panel discussions, comprise this volume, covering fan noise, STOL and rotor noise, acoustics of boundary layers and structural response, broadband noise generation, airfoil-wake interactions, blade spacing, supersonic fan, and inlet geometry. Studies of STOL and rotor noise cover mechanisms and prediction, suppression, spectral trends, and an engine-over-the-wing concept. Structural phenomena include panel response, high-temperature fatigue, and reentry vehicle loads, and boundary layer studies examine attached and separated turbulent pressure fluctuations, supersonic and hypersonic.

Sonic boom studies examine high-altitude overpressure, space shuttle boom, a low-boom supersonic transport, shock wave distortion, nonlinear acoustics, and far-field effects. Instrumentation includes a directional microphone, jet flow source location, various sensors, shear flow measurement, laser velocimeters, and comparisons of wind tunnel and flight test data.

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AEROACOUSTICS: JET AND COMBUSTION NOISE; DUCT ACOUSTICS

v. 37

Edited by Henry T. Nagamatsu, General Electric Research and Development Center; Jack V. O'Keefe, The Boeing Company; and Ira R. Schwartz, NASA Ames Research Center

A companion to Aeroacoustics: Fan, STOL, and Boundary Layer Noise; Sonic Boom; Aeroacoustic Instrumentation, volume 38 in the series.

This volume includes twenty-eight papers covering jet noise, combustion and core engine noise, and duct acoustics, with summaries of panel discussions. The papers on jet noise include theory and applications, jet noise formulation, sound distribution, acoustic radiation refraction, temperature effects, jets and suppressor characteristics, jets as acoustic shields, and acoustics of swirling jets.

Papers on combustion and core-generated noise cover both theory and practice, examining ducted combustion, open flames, and some early results of core noise studies.

Studies of duct acoustics discuss cross section variations and sheared flow, radiation in and from lined shear flow, helical flow interactions, emission from aircraft ducts, plane wave propagation in a variable area duct, nozzle wave propagation, mean flow in a lined duct, nonuniform waveguide propagation, flow noise in turbofans, annular duct phenomena, freestream turbulent acoustics, and vortex shedding in cavities.

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Edited by Joseph A. Schetz. Virginia Polytechnic Institute and State University

This volume presents seventeen papers concerned with the state of the art in dealing with the unnatural heating of waterways by industrial discharges, principally condenser cooling water attendant to electric power generation. The term "pollution" is used advisedly in this instance, since such heating of a waterway is not always necessarily detrimental. It is, however, true that the process is usually harmful, and thus the term has come into general use to describe the problem under consideration.

The magnitude of the Btu per hour so discharged into the waterways of the United States is astronomical. Although the temperature difference between the water received and that discharged seems small, it can strongly affect its biological system. And the general public often has a distorted view of the laws of thermodynamics and the causes of such heat rejection. This volume aims to provide a status report on the development of predictive analyses for temperature patterns in waterways with heated discharges, and to provide a concise reference work for those who wish to enter the field or need to use the results of such studies.

The papers range over a wide area of theory and practice, from theoretical mixing and system simulation to actual field measurements in real-time operations.

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THERMOPHYSICS AND SPACECRAFT THERMAL CONTROL
v. 35

Edited by Robert C. Hering, University of Iowa

This collection of thirty papers covers some of the most important current problems in thermophysics research and technology, including radiative heat transfer, surface radiation properties, conduction and joint conductance, heat pipes, and thermal control of spacecraft systems.

Radiative transfer papers examine the radiative transport equation, polluted atmospheres, zoning methods, perforated sheilding, gas spectra, and thermal modeling. Surface radiation papers report on dielectric coatings, refractive index and scattering, and coatings of still-orbiting spacecraft. These papers also cover high-temperature thermophysical measurements and optical characteristics of coatings.

Conduction studies examine metals and gaskets, joint shapes, materials, contamination effects, and prediction mechanisms.

Heat pipe studies include gas occlusions in pipes, mathematical methods in pipe design, cryogenic pipe design and test, a variable-conductance pipe, a pipe for the space shuttle electronics package, and OAO-C heat pipe performance data. Spacecraft thermal modeling and evaluating covers the Large Space Telescope, a Saturn/Uranua probe, a lunar instrumentation package, and the Mariner spacecraft.

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v. 34

Edited By Allen Fuhs, Naval Postgraduate School, and Marshall Kingery, Arnold Engineering Development Center

This volume presents thirty-nine studies in advanced instrumentation for turbojet engines, covering measurement and monitoring of internal inlet flow, compressor internal aerodynamics, turbojet, ramjet, and composite combustors, turbines, propulsion controls, and engine condition minotoring. Includes applications of techniques of holography, laser velocimetry, Raman scattering, fluorescence, and ultrasonics, in addition to refinements of existing techniques.

Both inflight and research instrumentation requirements are considered in evaluating what to measure and how to measure it. Critical new parameters for engine controls must be measured with improved instrumentation. Inlet flow monitoring covers transducers, test requirements, dynamic distortion, and advanced instrumentation applications. Compressor studies examine both basic phenomena and dynamic flow, with speical monitoring parameters.

Combustor applications review the state-of-the-art, proposing flowfield diagnosis and holography to monitor jets, nozzles, droplets, sprays, and particle combustion. Turbine monitoring, propulsion control sensing and pyrometry, and total engine condition monitoring, with cost factors, conclude the coverage.

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Edited by P. L. Bargellini, Comsat Laboratories
A companion to Communications Satellite Systems, volume 32 in the series.

The twenty-two papers in this volume deal with communications satellite operations, including orbit positioning and stability, propulsion and power requirements, and operations of the electronic communications system and network.

The orbit and attitude control papers cover stability, nutation dynamics, attitude determination, and three-axis control. Propulsion requirements examined include low-thrust stationkeeping requirements and auxiliary power systems for the satellite themselves.

Communications aspects include dual-beam reflector antennas, a method for measuring gain and noise temperature ratio of earth station antennas, and the Intelsat IV transponder. The time-division multiple access system for Intelsat, the synchronization of earth stations to satellite sequences, time division multiple access systems, and echo cancellation are also considered.

Multiple applications include single satellites for communications, air traffic control, television broadcasting, and a microwave telemetry and command band.

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A companion to Communications Satellite Technology, volume 33 in the series.

The twenty papers in this volume deal with international applications, advanced concepts, and special topics, covering the lessons and technical advancements resulting from the Intelsat II program of eight launches in the years 1966-1970. Includes Intelsat V system concepts and technology, with implications for multiple access, power generation and storage, and propellant utilization. It also includes proposals for U.S.-European cooperation in satellite applications programs of the Intelsat system.

Advanced concepts discussed include the coming generation of flexible communications satellites, with variations in switching, applications, and payloads; a dual-beam antenna for broadcast band service; high-powered, three-axis stabilized, position-keeping satellites; commercial communications with ships or aircraft via stationary satellites; multiple beam phased antennas; complex ground stations and relatively straightforward equipment on the satellite; and research in manned orbital laboratories.

Special topics include two-way telephonic communication via satellite, various education and information transfer systems, and a centralized radio-frequency data base for satellite communication system design.

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Twenty-eight papers concern the most important advances in thermal control as related to spacecraft thermal design, and in radiation phenomena in the thermal environment of space, covering heat pipes, thermal control by other means, gaseous radiation, and surface radiation.

Heat pipe section examines characteristics of several wick materials, a self-priming pipe and development models, and the design and fabrication of a twelve-foot pipe for the Orbiting Astronomical Observatory C, and the 26-inch diode for the ATS-F Satellite.

Other thermal control methods examined include alloys, thermal control coatings, and plasma cleaning of such coatings. Papers examine the thermal contact resistance of bolted joints and electrical contracts, with role of surface roughness in thermal conductivity.

Gaseous radiation studies examine multidimensional heat transfer, thermal shielding by injection of absorbing gases into the boundary layer, and various gases as thermal absorbing media. Surface studies deal with real surface effects on roughened, real-time contaminated surfaces, and with new computational techniques to compute heat transfer for complex geometries, to enhance the capabilities and accuracy of radiation computing.

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Edited by Patrick S. McIntosh and Murray Dryer, National Oceanic and Atmospheric Administration

The twenty-five papers in this volume present a representative view of solar-terrestrial physics, with emphasis on the sun, and on predicting solar activity affecting the space environment. It summarizes current knowledge of solar observations and theories, the interplanetary medium, geophysical responses to solar activity, and progress in the technology of forecasting such phenomena.

Solar activity variations, properties, and organization are reviewed in evaluating solar active regions and directions for further study. The structure of the solar magnetic field is explored, and current knowledge of solar flares and other activity is presented. Solar flares are modeled as an explosive release of magnetic energy associated with a current sheet in the solar magnetic field.

Interplanetary medium studies concern the solar wind and solar cosmic rays, with spacecraft observations of both. Solar activity effects on the earth's atmosphere, and relation of such activity to geomagnetic phenomena, are explored. Solar activity forecasting relates to flare activity prediction, both proton and nonproton, forecasting both incidence and solar flare location.

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v. 29

Edited by John W. Lucas, Jet Propulsion Laboratory

The thirty-two papers in this volume review the development of thermophysics and its constituent disciplines in relation to the space program, together with concerns for future development, in fields of surface radiation properties, thermal analysis, heat pipes, and thermal design.

Surface radiation covers ultraviolet and particle radiation of pigments, paints, and other surfaces, both coated and uncoated, in thermal control applications. Optical characteristics of variously degraded and exposed surfaces are also considered. Thermal analysis studies consider radiative heat transfer, thermal resistance, reentry thermal analysis, and modeling for spacecraft thermal analysis.

Heta pipes section covers friction, electro-osmosis, grooved pipes, organic-fluid pipes, gas-controlled pipes, variable-conductance pipes, and specific heat pipe designs and applications.

Thermal design topics include the Apollo telescope mount, the space shuttle orbiter wing cooling system, and methods and selection criteria for thermal control of a twelve-person space station.

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Edited by John W. Lucas, Jet Propulsion Laboratory

The eleven papers in this volume detail recent important discoveries in the lunar thermal situation, including measurements made from earth,

measurements made on the moon, studies of materials returned to earth from the moon, and an overall historical survey of the interior of the moon from a thermal standpoint.

Earth-based measurements concern infrared emission and hot spots, microwave emission from the moon, and radar reflection mapping of the surface, with comparisons of radar and infrared measurements.

In situ measurements summarize five unmanned Surveyor probes, using thermal sensor and solar panel data, plus various Apollo science experiments packages used to measure lunar surface brightness and heat flow.

Section on earth study of returned lunar materials reviews thermophysical properties of such materials, with descriptions of processes and tabular and graphic data. Data relate lunar surface roughness and thermal characteristics both in daytime and during nighttime and eclipses.

The historical geophysical interpretation of lunar thermal history, based on all available data from many sources, covers origins, energy balance, and models of thermal history, with comparisons of models and directions for future work.

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Edited by Willis L. Webb, White Sands Missile Range, and University of Texas at El Paso

The fifteen papers in this volume concern the geocirculation system occupying the atmospheric region above an altitude of 80 kilometers. They deal with the physical processes forming the structure of the base of the thermosphere, using data from sounding rockets and from radar observations of meteor trail ionization tracks.

Upper atmosphere dynamics summary presents a current model of thermosphere dynamics, proposing a program of synoptic exploration. Other papers explore lower ionospheric phenomena, the topside ionosphere, the magnetosphere, the upper atmosphere, and the origin and structure of noctilucent clouds.

Radar observations of wind structure height and time, based on meteor radar tracking, are presented, with implications of and for various terrestrial weather phenomena. Other studies cover automated digital signal processing and monitoring of radar data from meteor trails.

Other papers explore the morphology of the D-region, the chemistry of the upper mesosphere and the lower thermosphere, airglow phenomena, and proposals for data collection, reduction, and dissemination for study.

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Edited by Nathaniel E. Feldman, The Rand Corporation, and Charles M. Kelly, The Aerospace Corporation
A companion to Communication Satellites for the 70's: Technology, volume 25 in the series.

This collection of thirty-seven papers discusses a wide variety of operational, experimental, and proposed specific satellite systems, including the Canadian domestic communications satellite system, European projects, systems for emerging nations, United States domestic systems, aeronautical service systems, earth resources satellites, defense systems, systems engineering, and the relative merits of various stabilization systems for future synchronous satellites.

Both Telesat Canada and Canadian Broadcasting Corporation satellites are discussed. European projects include efforts of France, Germany, and Italy. Emerging nations systems include those for Brazil and India.

Unites States instructional and educational systems are described, with extensions for earth resources monitoring. The Defense Satellite Communication System is examined, and a global network using both satellites and submarine cables is proposed. Bandwidth frequency assignment is proposed for maximum utility and service.

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Edited by Nathaniel E. Feldman, The Rand Corporation, and Charles M. Kelly, The Aerospace Corporation
A companion to Communication Satellites for the 70's: Systems, volume 26 in the series.

The thirty-six papers in this volume cover developments in satellite transponders, subsystems, antennas, high-power transmission, integration and testing, launch vehicles, digital techniques, and earth station technology.

Equipment analyzed and evaluated includes traveling-wave tubes for space applications, S-band power amplifier tubes, and complex multiplexed filers for waveguide combinations. Antennas evaluated for communications satellites include phased-array, mechanically despun, variable-coverage, and narrow-bandwidth types.

Stabilization systems examined include spin-stabilization, three-axis attitude control, horizon sensing, and visible light earth sensors for satellites in equatorial orbit.

Power studies examine high-power satellite design, fabrication, and testing, and high-power television transmitters. Interference between satellite and terrestrial transmissions is explored. A low-cost microwave converter is proposed.

Various switching options for multiple-access and demand switching are proposed, and various low-cost, low-power ground stations are presented.

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HEAT TRANSFER AND SPACECRAFT THERMAL CONTROL
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Edited by John W. Lucas, Jet Propulsion Laboratory

This volume presents a review of the state of the art of thermophysics in aerospace, surface radiation properties, thermal joint conductance, heat transfer, multilayer insulation, and thermal control devices.

A critical review of aerospace thermophysics examines the tasks presented by the space shuttle and

space stations, including thermal control surfaces having lifetimes up to 20 years. Other studies examine degradation and stabilization of thermal control coatings, with radiant heat transfer calculations. The emittance of several coated and uncoated metal surfaces is calculated, with data on time and exposure degradation.

Thermal joint conductance studies examine prediction of conductance, heating rates, and the influence of interstitial fillers on heat transfer. Other papers cover heat transfer modeling, transient heat flow in structures, and the special heat transfer problems of multilayer insulations, both in structures and in space suits.

Papers dealing with thermal control devices discuss selection criteria, mutual interaction between electric and thermal conduction, and thermal efficiency of various materials used in spacecraft structures.

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Sergre, E., ed., *Experimental Nuclear Physics*, 1st Ed., Vol. 1, Wiley, New York, 1963, pp. 6-10.

3) Reports: Book, E. and Bratman, H., "Using Compilers to Build Compilers," Systems Development Corp., Santa Monica, Calif., SP-176, Aug. 1960.

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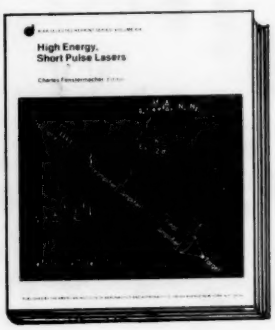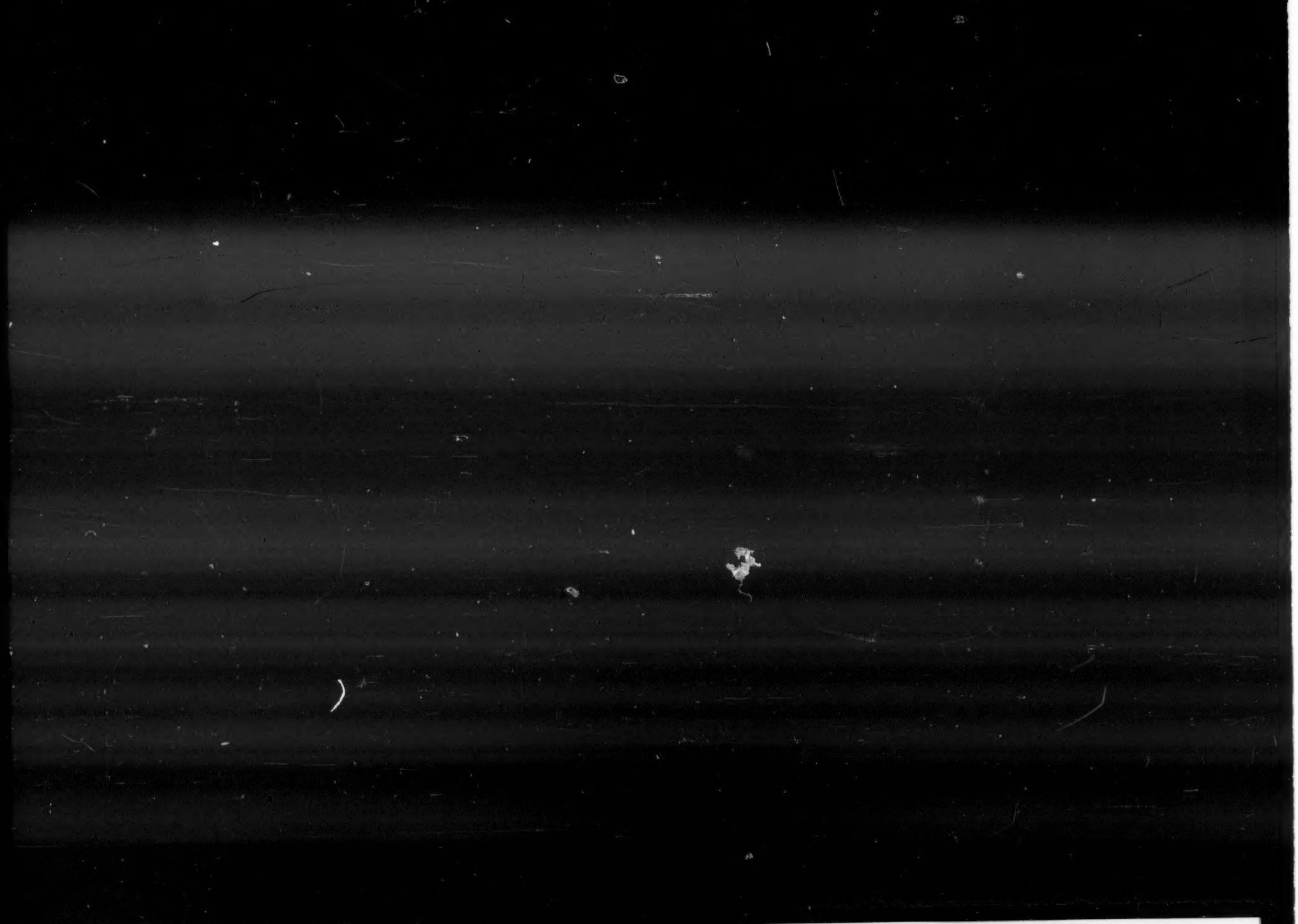
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